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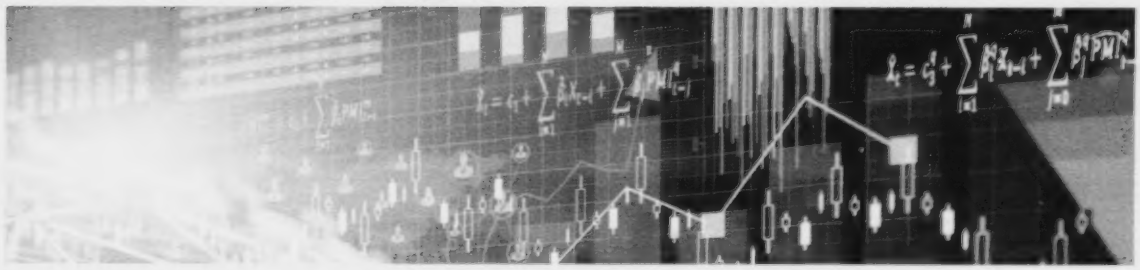
Disaggregating Household Sensitivity to Monetary Policy by Expenditure Category



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Abstract

Because the Bank of Canada has started withdrawing monetary stimulus, monitoring the transmission of these changes to monetary policy will be important. Subcomponents of consumption and housing will likely respond differently to a monetary policy tightening, both in terms of the aggregate effect and timing. These differences may be informative for monitoring household responsiveness to, and tracking the transmission of, changes to monetary policy. The authors therefore estimate an empirical model to measure the effects of monetary policy shocks on household expenditures. We find that monetary policy shocks will have a greater, and generally quicker, effect on residential investment than they do on consumption. On average across interest-rate-sensitive subcomponents of real household expenditure, most of the impact is felt on the level after about seven quarters. For residential investment, new construction and ownership transfer costs are affected the most. For consumption, durables and items thought to be highly discretionary (e.g., food and beverages away from home and accommodation services), appear most sensitive to monetary policy shocks.

Bank topics: Business fluctuation and cycles; Domestic demand and components; Econometric and statistical methods; Housing; Interest rates; Transmission of monetary policy; Recent economic and financial developments
JEL codes: E, E21, E22, E43, E47, E52 and C32

Résumé

Comme la Banque du Canada a commencé à procéder à des relèvements du taux directeur pour réduire la détente monétaire en place, il importera de surveiller la transmission de ces changements de la politique monétaire. Les sous-composantes de la consommation et du logement risquent de réagir différemment à un resserrement de la politique monétaire, tant pour ce qui est des effets globaux que du moment où ces réactions se manifesteront. Ces différences peuvent fournir des renseignements utiles pour assurer le suivi de la transmission des modifications de la politique monétaire ainsi que pour surveiller la réactivité des ménages à ces changements. Pour mesurer les effets des chocs de politique monétaire sur les dépenses des ménages, nous estimons un modèle empirique. Nous constatons que ces chocs auront sur les investissements résidentiels une incidence plus grande (et habituellement plus rapide) que sur la consommation. Dans les catégories des dépenses réelles des ménages sensibles aux taux

d'intérêt, les effets se font, en moyenne, le plus sentir sur le niveau des dépenses au bout d'environ sept trimestres. S'agissant des investissements résidentiels, ce sont les constructions neuves et les coûts de transfert de propriété qui sont les plus touchés. Enfin, concernant la consommation, les biens durables et les articles jugés très discrétionnaires (p. ex., dépenses de restaurant et services d'hébergement) sont les composantes les plus sensibles aux chocs de politique monétaire.

Sujets : Cycles et fluctuations économiques; Demande intérieure et composantes; Méthodes économétriques et statistiques; Logement; Taux d'intérêt; Transmission de la politique monétaire; Évolution économique et financière récente
Codes JEL : E, E21, E22, E32, E43, E47, E52 et C32

1. Motivation and summary

The Bank of Canada began withdrawing monetary stimulus in the summer of 2017, and monitoring the transmission of these changes will be important. Subcomponents of consumption and housing will likely respond differently to a monetary policy tightening, both in terms of the aggregate impact and timing. These differences may be informative for monitoring household responsiveness to, and tracking the transmission of, changes to monetary policy. While our policy models can provide indications of the impact and timing of monetary policy actions on aggregate expenditure components, detailed responses for the subcomponents are largely absent.

This paper therefore aims to better understand which components of household expenditures tend to be most sensitive to changes to interest rates. We also assess the horizon within which the effects of such changes should be felt. To do this we estimate the impact of monetary policy shocks on consumption and residential investment, including their subcomponents, using a flexible estimation strategy outside our regular policy tools. We employ the Champagne and Sekkel (2018) measure of monetary policy shocks to ensure the use of an exogenous instrument for interest rate changes and estimate the impact of such shocks over different time horizons to construct impulse response functions (this approach is also called "local projections"). To support the results from that strategy, we also review the cycle-on-cycle evolution of these components of housing and consumption during past tightening cycles. Key takeaways are the following:

- Our empirical model suggests that monetary policy shocks will affect residential investment more than they affect consumption and that such responses are generally quicker. On average, across the subcomponents of household expenditures that are most sensitive to interest rates, most of the impact is felt after about seven quarters (e.g., mid-2019 from a rate increase in the third quarter of 2017).[1]
    - For consumption, durables subcomponents (motor vehicles and furniture) and those that can be thought of as being highly discretionary (other transportation services, communications, and food (away from home), beverage and accommodation services), are most sensitive to monetary policy shocks.[2]

[1] This refers to the amount of time it takes for 75 per cent of the peak impact to be reached on the respective expenditure component. We focus on 75 per cent because, beyond this amount, changes in the subcomponents tend to be small and would be difficult to track in real time.

[2] Other transportation services include air, railway, taxis, water and urban transportation.

    - For housing, all three subcomponents show high sensitivity to interest rate changes, with the largest impact on new construction and ownership transfer costs (OTC), while renovations are slightly less affected.
- Cycle-on-cycle analysis supports the broad conclusions above. Specifically, following the start of a cycle of interest rate tightening, the components identified as sensitive to interest rates slow by a greater degree than other components of household expenditures.

2. Gauging the effects of monetary policy on real activity: why focus on shocks and how to identify them

As noted by Cloyne and Hürtgen (2016), identifying the effects of changes in monetary policy on the real economy faces several challenges. These include the simultaneous determination of monetary policy instruments, interest rates and other macroeconomic variables; the endogenous nature of monetary policy decisions, which react to future, current and past information; and the real-time nature of policy decisions. These challenges have spurred a large literature on identifying exogenous shocks to allow for a more robust estimation of causal effects.

Shocks, as described by Ramey (2016), are primitive exogenous forces uncorrelated with each other that are economically meaningful. In this paper, we use the monetary policy shock series constructed in Champagne and Sekkel (2018). This is an application of the Romer and Romer (2004) narrative method of identifying monetary policy shocks, which is one of the premier identification strategies. Cochrane (2004) provides an excellent discussion on the merits of this identification strategy. The key insight is that the statistic constructed from this procedure is an exogenous instrument. Since movements in monetary policy are endogenous—a move is always a response to something—simply running a regression with monetary policy changes is not credible. As noted in past research (e.g., Romer and Romer 2004; Cloyne and Hürtgen 2016), careful identification of the shocks is important because failure to use a measure of monetary policy that is purged of endogeneity (i.e., systematic policy changes) can lead to smaller estimates of the effect of monetary policy and an associated price puzzle (i.e., prices and inflation increase following a monetary policy tightening).

Specifically, Champagne and Sekkel (2018) regress the target policy rate on real-time and forecasts for growth of gross domestic product (GDP) and inflation from the Bank of Canada staff economic projections. The residual from this regression is a measure of changes in interest rates that is orthogonal to information about past, current and future

expected economic conditions. Given the historical Canadian monetary policy framework, Champagne and Sekkel also control for the US federal funds rate, Canada–US bilateral exchange rate and the introduction of inflation targeting in their regression specification. The lack of predictability of the resulting shock series from a large set of lagged macroeconomic variables supports the usefulness of this variable for identifying the effects of monetary policy in Canada.

3. Estimation methodology

We use the Champagne and Sekkel (2018) monetary policy shock series to calculate impulse response functions. The goal is to identify the most interest-rate-sensitive components of consumption and housing to help track the effects of monetary policy in real time. To do this, we use a local projection approach following Jordà (2005). The local projection approach involves regressing the exogenous change in the policy rate on the change in the level of the target series over a horizon of h quarters. The impulse response is then the coefficients from the set of regressions. This is an appealing alternative to vector autoregression (VAR) models because local projections tend to be more robust to misspecification. This approach would be more flexible and would accommodate nonlinearities. Specifically, we estimate the following set of regressions for each impulse response horizon (h):

$$y_{t+h} - y_t = c + \gamma_h(L)z_{t-1} + \beta_h shock_t + \alpha_h(L)shock_{t-1} + \epsilon_{t+h} \text{ for } h = 0, 1, 2 \ldots 20, \quad (1)$$

where y is the component of consumption or housing of interest (in volume terms), z_{t-1} is a vector of control variables (which can include lags of the dependent variable), $\gamma_h(L)$ and $\alpha_h(L)$ are lag operators, and $shock$ refers to the Champagne and Sekkel (2018) measure of monetary policy shocks. β_h estimated above are the impulse responses for each horizon h. A complete list of the consumption and housing components considered are provided in Appendix A.

Given the availability of the shock series, we estimate the model from 1974 to 2015 on a quarterly basis, using four lags of the dependent and control variable and eight lags of the shock variable. The choice of lags matches the specification in Champagne and Sekkel (2018), and the results are robust to changes in specification. In principle, if the monetary policy shock measure is properly identified, it is not necessary to control for additional variables. However, one can argue that the specification is not perfect and that we should therefore control for additional variables to reduce any potential bias. We did not find that additional controls made significant differences in the results, but we think it is worthwhile to include a few marginal controls. The controls we used were real labour

income,[3] the Bank of Canada commodity price index (BCPI) in real terms (converted to Canadian dollars and deflated with the consumer price index, or CPI) and the Canada–US bilateral exchange rate. Alternative controls did not significantly affect the estimates and main conclusions.[4, 5]

Key results from the models

Table 1, Chart 1 and **Chart 2** summarize the effects of a 100-basis-point contractionary monetary policy shock on residential investment, consumption and their main subcomponents. The detailed impulse response functions can be found in Appendix B. Specifically, in **Table 1** (at the end of this section), we note the estimated impact on the level of these components as well as the timing of this peak response in number of quarters. We also include the timing of when 75 per cent of the peak impact should be felt because, in many cases, beyond this quarter the marginal quarterly changes become quite small and would be difficult to track in real time, especially given the multitude of forces at play.

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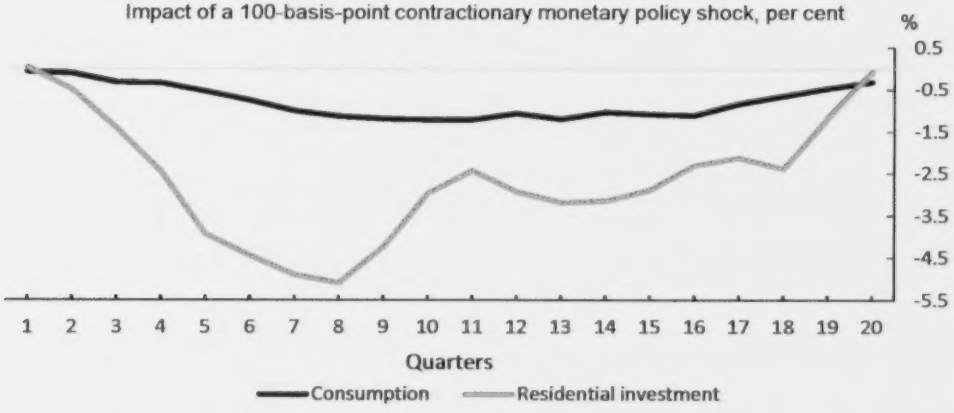
[3] Real labour income is calculated as total compensation of employees deflated by the consumer price index.

[4] For example, while the correlation of the monetary policy shock series and the bilateral Canada–US exchange rate was very low over the entire sample, we nonetheless tested to see if including the terms of trade rather than the BCPI and the Canada–US bilateral exchange rate would make a difference in the results. Following this substitution, however, the results remain broadly unchanged. We also tested whether including real house prices made a difference for the housing subcomponents; however, the results remain in line with the estimates that exclude this variable.

[5] For the housing subcomponents, we also tried including a control for macroprudential policy changes (i.e., the maximum loan-to-value ratio because it tended to show more variance through time relative to other potential controls); however, the broad conclusions remain the same. Moreover, to better understand the impact of this shock series on short-term rates, we provide in Appendix C the impulse response function of a 100-basis-point contractionary monetary policy shock on the Bank Rate (**Chart C1**).

Chart 1: **Aggregate consumption and housing responses to monetary policy shocks**

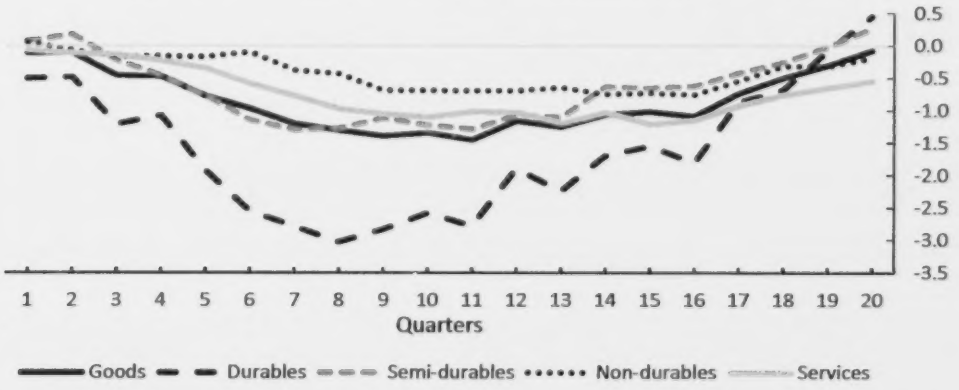
Impact of a 100-basis-point contractionary monetary policy shock, per cent



Source: Bank of Canada calculations and estimates

Chart 2: **Impact of monetary policy shocks on main consumption aggregates**

Impact of a 100-basis-point contractionary monetary policy shock, per cent



Source: Bank of Canada calculations and estimates

Intuitively, residential investment is more sensitive to monetary policy than consumption is because purchases are more likely to be funded with debt. Based on this methodology, the peak effect on the level is -5.1 per cent after eight quarters, relative to a more modest -1.2 per cent for consumption. These magnitudes are consistent with the empirical literature, which uses the Romer and Romer (2004) methodology (see Champagne and Sekkel 2018). Moreover, the peak impact of monetary policy changes on consumption is also slightly lagged relative to residential investment (75 per cent of the impact is reached by seven quarters relative to five quarters for housing).

The drag on residential investment is primarily driven by new construction and ownership transfer costs (OTC), with the latter reacting faster (75 per cent of the peak response is within four quarters relative to seven quarters for new construction). The relatively slower response of new construction compared with OTC may reflect, in part, supply frictions.[6] Renovation, while also affected by changes in monetary policy, experiences a more modest drag than OTC and new construction and its response is slightly delayed relative to OTC.

On the consumption side, goods consumption is slightly more sensitive than that of services, with the largest effects on durable goods consumption. This is not surprising because the category includes large ticket items, which are more likely to be funded with debt. Services and non-durables display the lowest responsiveness to monetary policy shocks, likely given a larger share of necessities (e.g., food and health expenditures). Regarding the timing of these responses, durables and semi-durables respond the quickest (75 per cent of the impact after six quarters), while non-durables and services are more delayed (75 per cent of the impact after nine and eight quarters, respectively). For the more disaggregated consumption categories, as expected, large ticket and more discretionary purchases like motor vehicles, other transportation services, communications and furniture tend to be some of the more sensitive categories (**Chart 3**).[7] At the same time, essential items such as food and beverages, health expenditures, housing user costs, and education are less responsive.[8] Below are some key takeaways:

- Motor vehicle purchases, other transportation services and furniture show the greatest sensitivity to monetary policy shocks, with a peak impact of -4.1, -3.5 and -2.4 per cent, respectively. Moreover, the impact is relatively quick, with 75 per cent of the impact occurring within six to seven quarters.
- Food (away from home), beverages and accommodation services, which would be more discretionary in nature, show a peak response of -2.0 per cent, while the

[6] This would be the case both in terms of a stimulative monetary policy shock because it would take time to get permits and start construction and because the added value of work conducted on a project typically follows a hump-shaped pattern. On the downside, it may take time to adjust as projects already under construction would likely continue.

[7] Communications includes the purchase of telecommunication services, telecommunication equipment and postal services. Other transportation services include air, railway, taxi, water and urban transportation.

[8] Housing user cost (a consumption component related to living in an owned dwelling) is only moderately responsive to monetary policy shocks and is linked to new construction because it grows in line with the housing stock. Given that additions to the housing stock are sensitive to monetary policy shocks, but would be small relative to existing stocks of dwellings, housing user costs exhibit a more muted and drawn out response to monetary policy shocks than the housing components do.

response is a bit more lagged (75 per cent of impact occurring after nine quarters). Dwelling maintenance has a similar response, with a peak impact of -1.9 per cent (75 per cent of impact occurring after 10 quarters). [9]

- Communications show a high degree of sensitivity (peak: -2.7 per cent), although the response time is relatively slow (75 per cent of the impact reached only after 11 quarters).

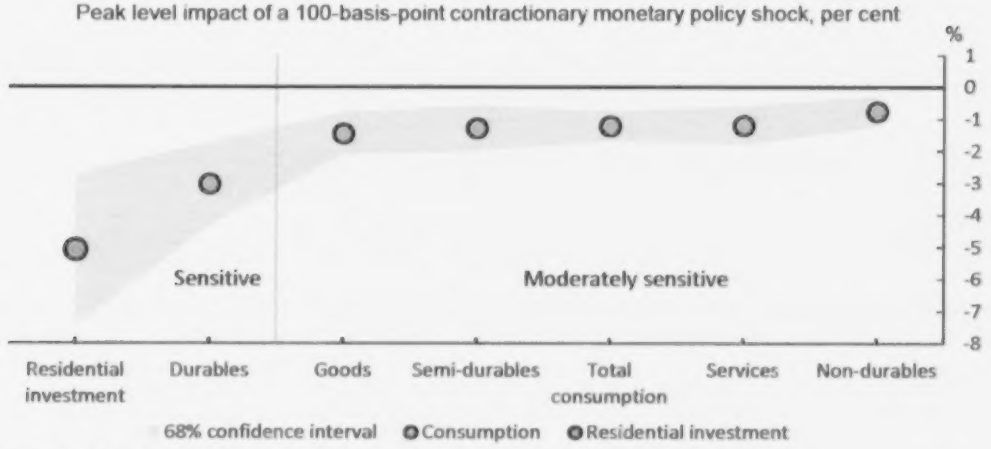
Using these results, we classify the aggregates into three categories: interest rate sensitive, moderately sensitive and not interest rate sensitive. We define components that are interest rate sensitive as those that react to a 100-basis-point monetary policy shock with a peak impact greater than the average consumption subcategory (>1.7 per cent on the level in absolute terms). Moderately sensitive components are those with an impact equal to or less than the average (1.7 per cent in absolute terms) but statistically significant from zero using a 68 per cent confidence interval. Components are not sensitive to interest rates if their impact is less than average but not significant based on similar confidence intervals (as noted in **Table 1** and **Chart 3** and **Chart 4**).[10]

[9] Dwelling maintenance includes expenditures on materials and services for the maintenance and repair of dwellings that would be small enough in scale not to be considered investment.

[10] We use 68 per cent confidence intervals because this would imply values that are within one standard deviation of the model estimate.

Chart 3: **Consumption and residential investment sensitivity to monetary policy shocks**

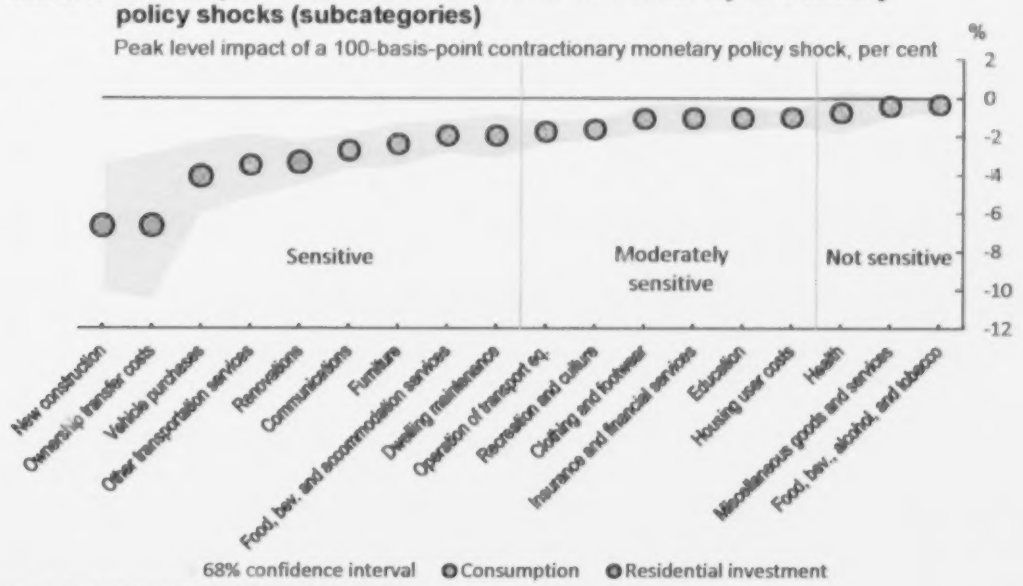
Peak level impact of a 100-basis-point contractionary monetary policy shock, per cent



Source: Bank of Canada calculations and estimates

Chart 4: **Consumption and residential investment sensitivity to monetary policy shocks (subcategories)**

Peak level impact of a 100-basis-point contractionary monetary policy shock, per cent



Source: Bank of Canada calculations and estimates

Table 1: Sensitivity of consumption and housing categories to a 100-basis-point contractionary monetary policy shock

Category*	Peak impact on level (per cent)	Timing of peak (quarters)	Timing of 75% of peak (quarters)	Characterization
Residential investment	-5.1	8	5	Sensitive
New construction (0.43)	-6.7	8	7	Sensitive
Ownership transfer costs (0.22)	-6.7	5	4	Sensitive
Renovations (0.35)	-3.4	8	6	Sensitive
Consumption*	-1.2	10	7	Moderately sensitive
Goods (0.44)	-1.5	11	7	Moderately sensitive
Durables (0.13)	-3.0	8	6	Sensitive
Semi-durables (0.07)	-1.3	7	6	Moderately sensitive
Non-durables (0.24)	-0.8	14	9	Moderately sensitive
Services (0.56)	-1.2	15	8	Moderately sensitive
Vehicle purchases (0.07)	-4.1	8	6	Sensitive
Other transportation services (0.02)	-3.5	11	7	Sensitive
Communications (0.03)	-2.7	16	11	Sensitive
Furniture (0.05)	-2.4	11	6	Sensitive
Food, beverage and accommodation services (0.07)	-2.0	10	9	Sensitive
Dwelling maintenance (0.003)	-1.9	11	10	Sensitive
Operation of transport equipment (0.06)	-1.7	7	7	Moderately sensitive
Recreation and culture (0.08)	-1.6	10	7	Moderately sensitive
Clothing and footwear (0.04)	-1.1	7	6	Moderately sensitive
Insurance and financial services (0.09)	-1.0	7	6	Moderately sensitive
Education (0.02)	-1.0	13	10	Moderately sensitive
Housing user costs (0.24)	-1.0	16	15	Moderately sensitive
Health (0.04)	-0.7	16	12	Not sensitive
Miscellaneous goods and services (0.05)	-0.4	12	11	Not sensitive
Food, beverages, alcohol and tobacco (0.12)	-0.3	14	10	Not sensitive
Average disaggregated consumption response	-1.7	11	9	

*Data in parenthesis reflect the nominal share of respective expenditure category in 2017
**Aggregate consumption includes non-profit institutions serving households
Source: Bank of Canada calculations and estimates

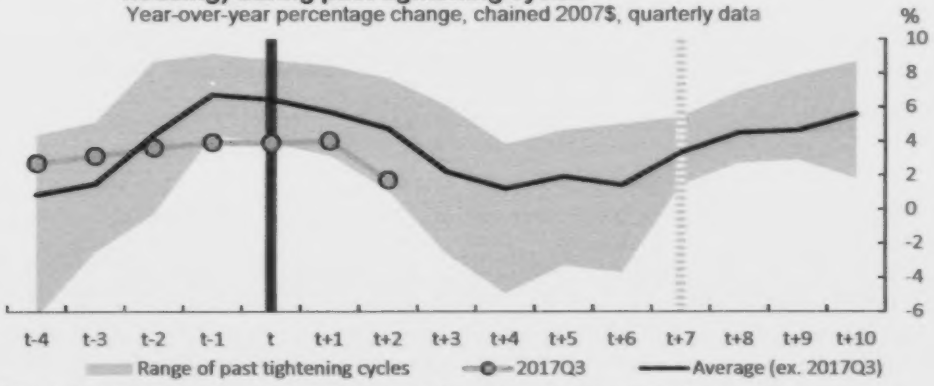
4. Tracking interest-rate-sensitive components in previous tightening cycles

Using the categories proposed above, we look at the evolution of the interest-rate-sensitive components during past tightening cycles (start dates of the cycles are highlighted in Appendix C, **Chart C2**), partly as a cross-check of our results above. Note, here we use cycle-on-cycle analysis rather than look at pure monetary policy shocks; therefore, the results would differ for several reasons. First, the effect in the actual expenditure data may differ, particularly if households reacted in anticipation of interest rate changes. Moreover, the severity of the tightening cycle would matter for the evolution of these components. For example, the tightening cycle that began in the second quarter of 1994 was relatively steep and reached the highest interest rates over the sample we look at (1993 to present). In addition, year-over-year growth at the start

of this tightening cycle was relatively weak for some components compared with past tightening cycles (e.g., residential investment), which may play a role in the post-tightening dynamics. More generally, other shocks and underlying factors would affect the dynamics of these expenditures beyond interest rate movements. With this in mind, following the start of a tightening cycle, annual growth generally eases in these components, as would be expected given our empirical results presented above (**Chart 5**). This is also the case when looking strictly at consumption components classified as interest rate sensitive (**Chart 6**).[11]

Chart 5: **Evolution of interest-rate-sensitive components (including housing) during past tightening cycles***

Year-over-year percentage change, chained 2007$, quarterly data



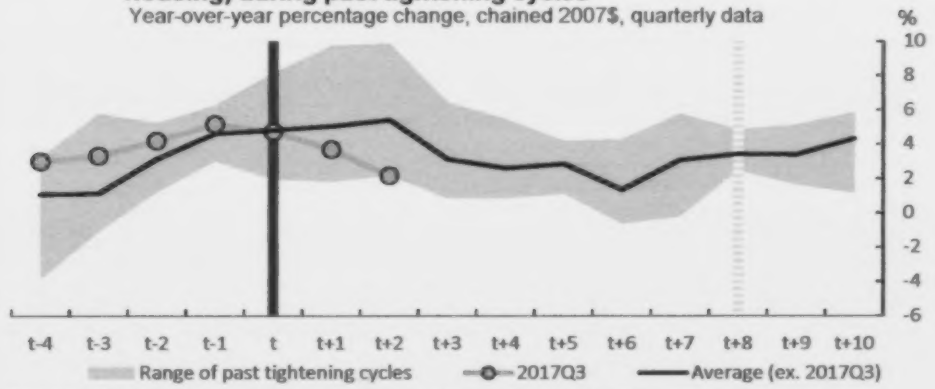
*The dashed line denotes when 75 per cent of the peak impact is reached based on a simple average.

Source: Bank of Canada calculations and estimates

[11] For reference, in Chart 5 and Chart 6 we note when 75 per cent of the peak impact on the level of each subcomponent should be felt if the tightening occurred at time *t* (denoted by the grey dashed line), based on our impulse response functions from the previous section. On average for these components deemed interest rate sensitive, this occurred after about seven quarters. Therefore, for the interest rate increases that occurred in 2017Q3, most the impact on these components should be felt by the second quarter of 2019, though there is considerable range by subcomponent.

Chart 6: **Evolution of interest-rate-sensitive components (excluding housing) during past tightening cycles***

Year-over-year percentage change, chained 2007$, quarterly data

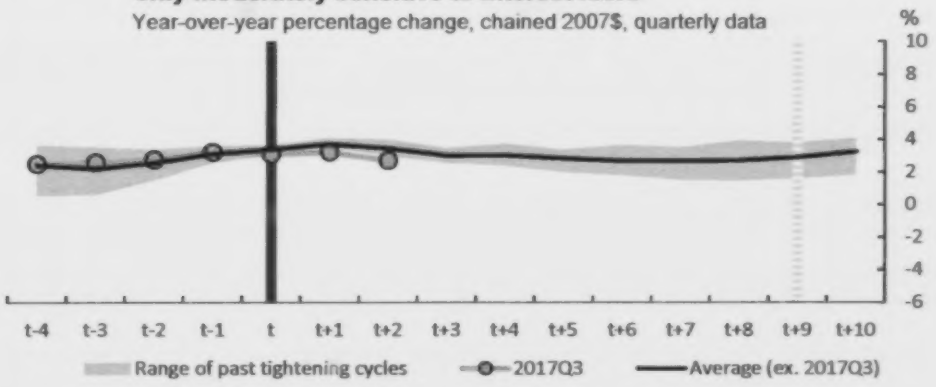


*The dashed line denotes when 75 per cent of the peak impact is reached based on a simple average.
Source: Bank of Canada calculations and estimates

As found in the previous section, following the start of an interest rate tightening cycle, components of residential investment, namely new construction and OTC, and motor vehicles, tend to weaken the most (see **Table C1** in Appendix C). Meanwhile, components classified as moderately sensitive and not interest rate sensitive, tend to weaken less following the start of a tightening cycle (**Chart 7**).

Chart 7: **Evolution of expenditure components that are not sensitive or only moderately sensitive to interest rates***

Year-over-year percentage change, chained 2007$, quarterly data



*The dashed line denotes when 75 per cent of the peak impact is reached based on a simple average.
Source: Bank of Canada calculations and estimates

5. Conclusion

In brief, we estimate an empirical model to measure the effects of monetary policy shocks on household expenditures. We find that monetary policy shocks will affect residential investment more than they affect consumption, which is consistent with our projection models. On average, across the most interest-rate-sensitive subcomponents of household expenditures, most of the volume impact is felt on the level after about seven quarters (e.g., mid-2019 from a rate increase in 2017Q3). For residential investment, new construction and OTC are affected the most. For consumption, durables and items thought to be highly discretionary are most sensitive to monetary shocks.

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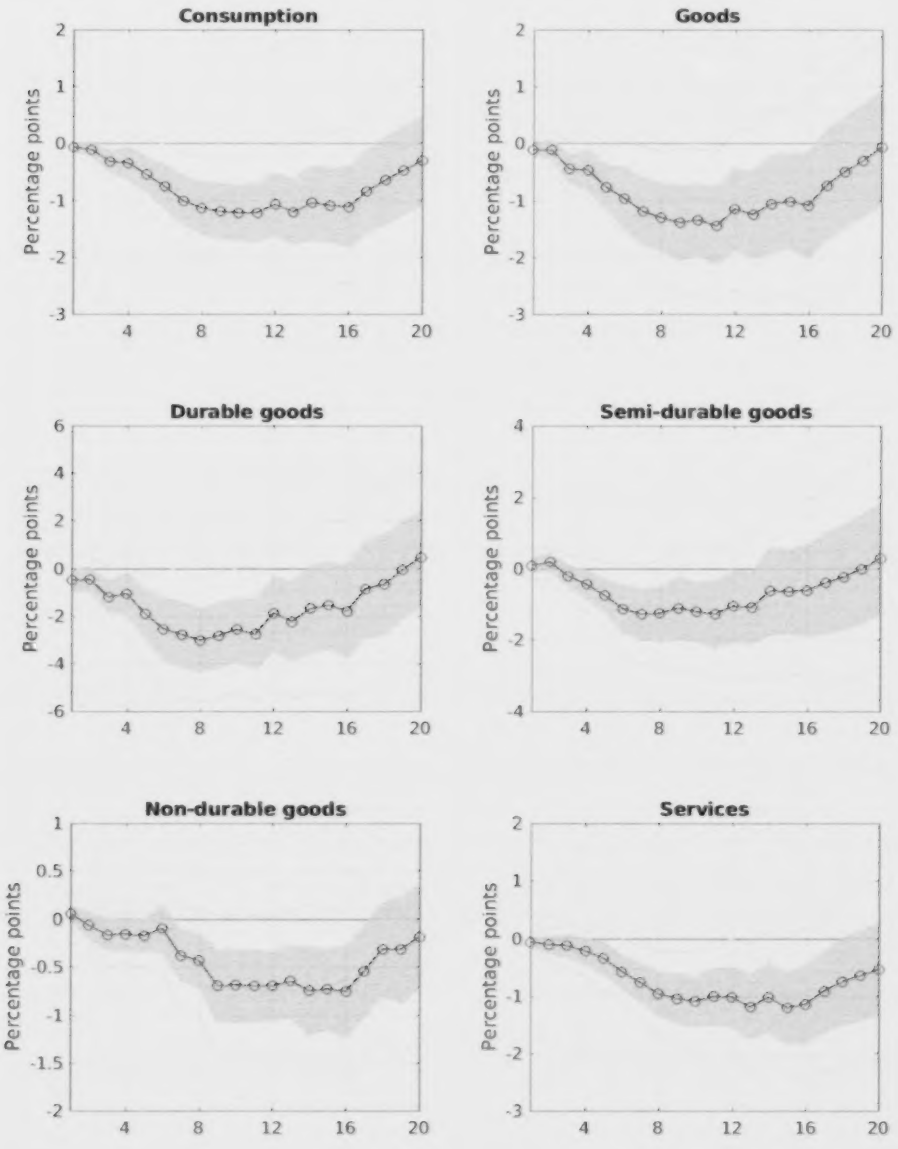
Appendix A: Consumption and housing series considered

Table A1: Housing and consumption source data	
Category	**Statistics Canada series identifier***
Residential investment	v62143961
New construction	v62143962
Ownership transfer costs	v62143964
Renovations	v62143963
Consumption	v62305724+v62305730
Goods	v61989013
Durables	v61989014
Semi-durables	v61989015
Non-durables	v61989016
Services	v61989017
Clothing and footwear	v61988964
Communications	v61988987
Dwelling maintenance	v61988970
Education	v61988995
Food, beverage and accommodation services	v61988997
Food, beverage, alcohol, and tobacco	v61988958+v61988961
Furniture	v61988973
Health	v61988979
Housing user costs	v61988968+v61988969+v61988971+v61988972
Insurance and financial services	v61989000
Miscellaneous goods and services	v61989004
Operation of transport eq.	v61988985
Other transportation services	v61988986
Recreation and culture	v61988989
Vehicle purchases	v61988984

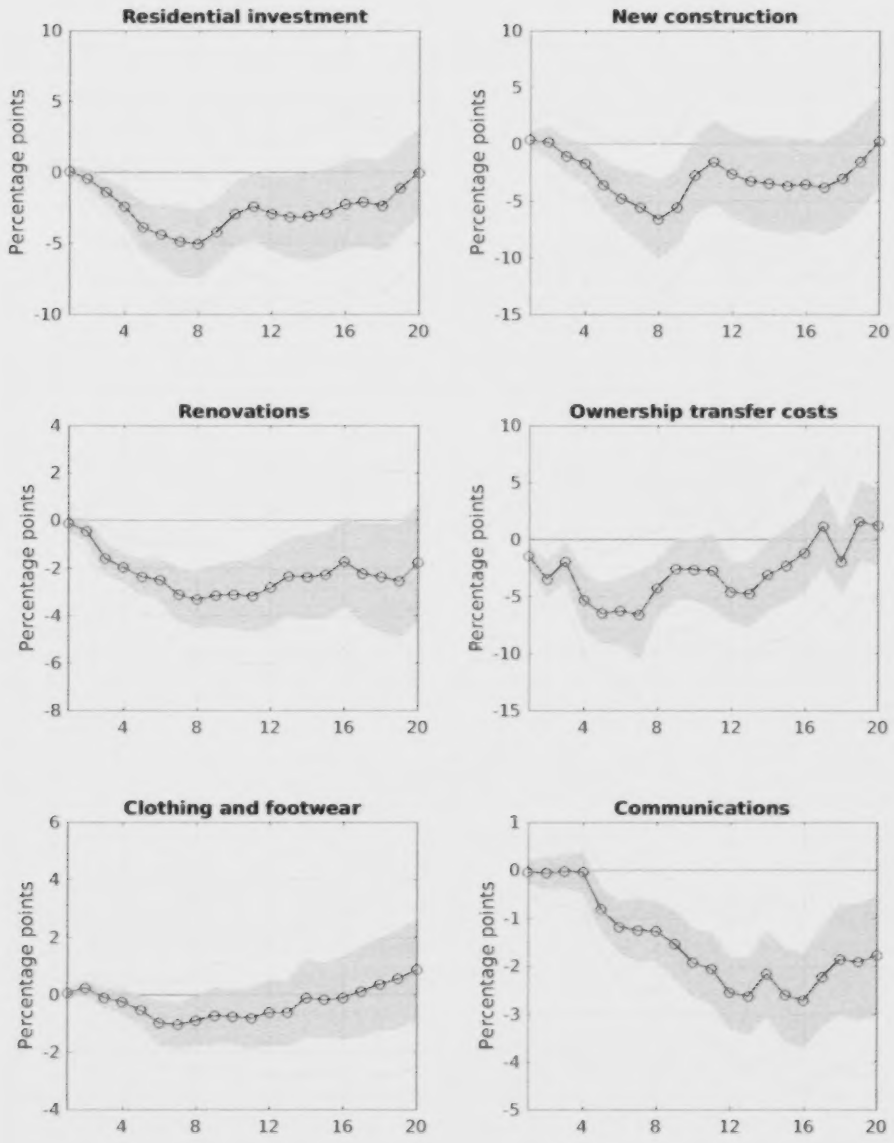
**All subcomponents that involve more than one series have been chained.*

Appendix B: Impulse response functions

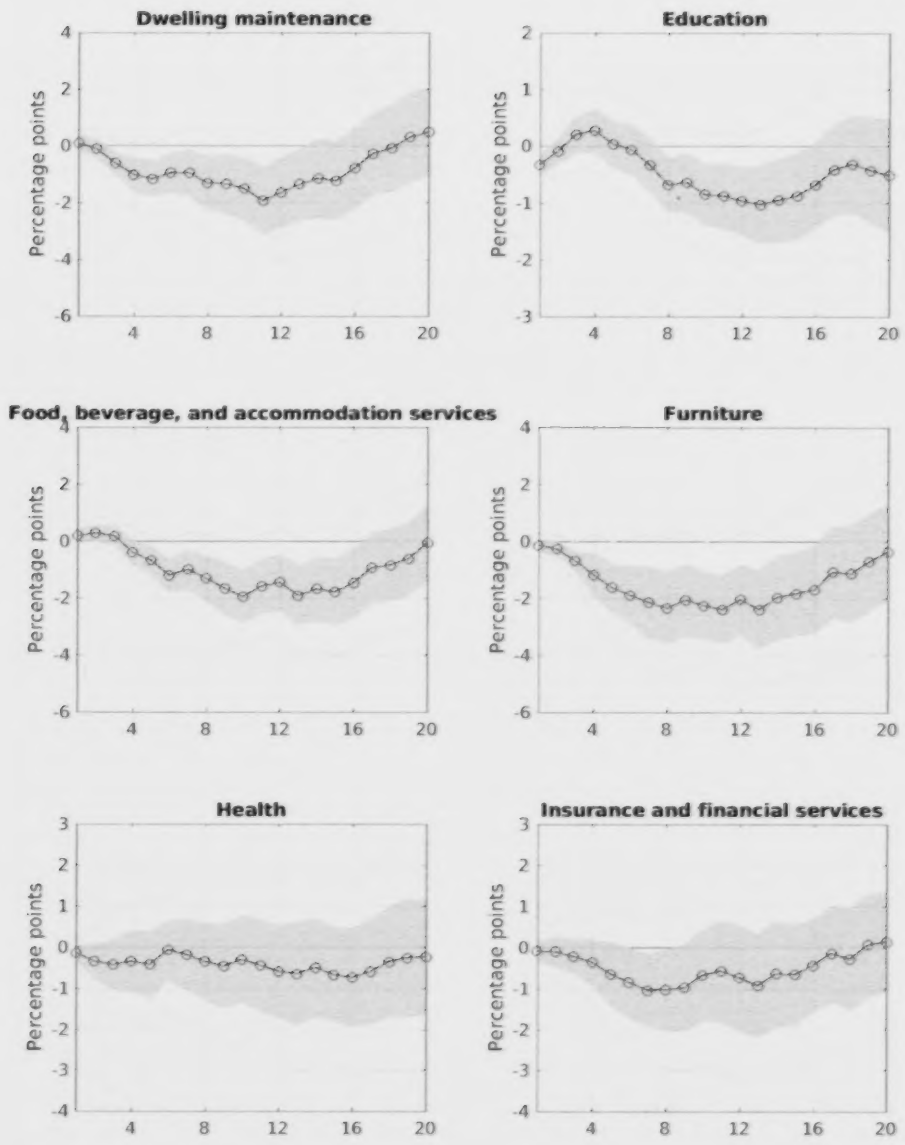
Chart B1: Impulse response functions of a 100-basis-point contractionary monetary policy shock on consumption and housing



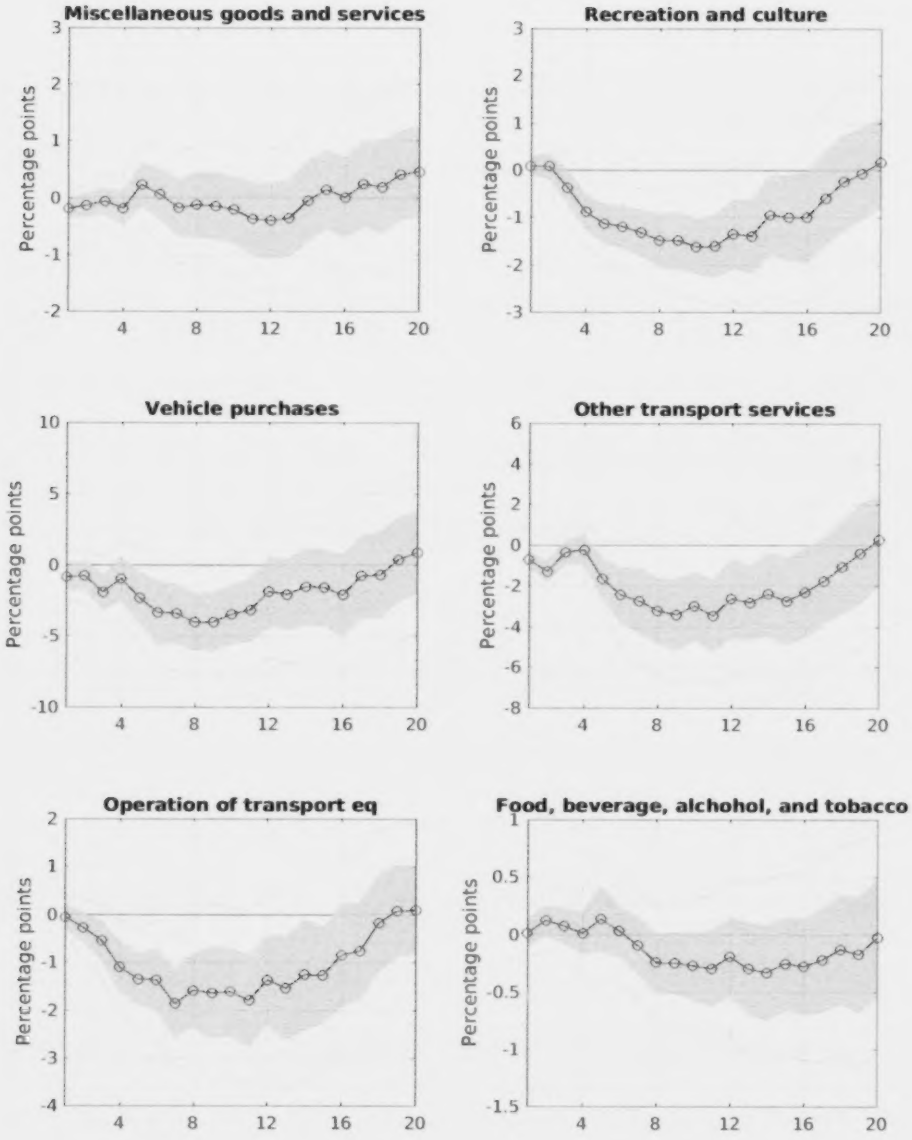
Note: Impulse responses to a 100-basis-point contractionary monetary policy shock with corresponding 68 and 95 per cent confidence bands
Source: Bank of Canada calculations and estimates



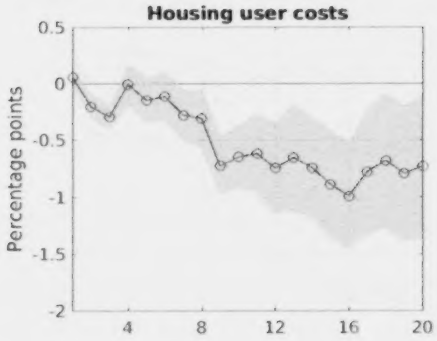
Note: Impulse responses to a 100-basis-point contractionary monetary policy shock with corresponding 68 and 95 per cent confidence bands.
Source: Bank of Canada calculations and estimates



Note: Impulse responses to a 100-basis-point contractionary monetary policy shock with corresponding 68 and 95 per cent confidence bands.
Source: Bank of Canada calculations and estimates



Note: Impulse responses to a 100-basis-point contractionary monetary policy shock with corresponding 68 and 95 per cent confidence bands.
Source: Bank of Canada calculations and estimates

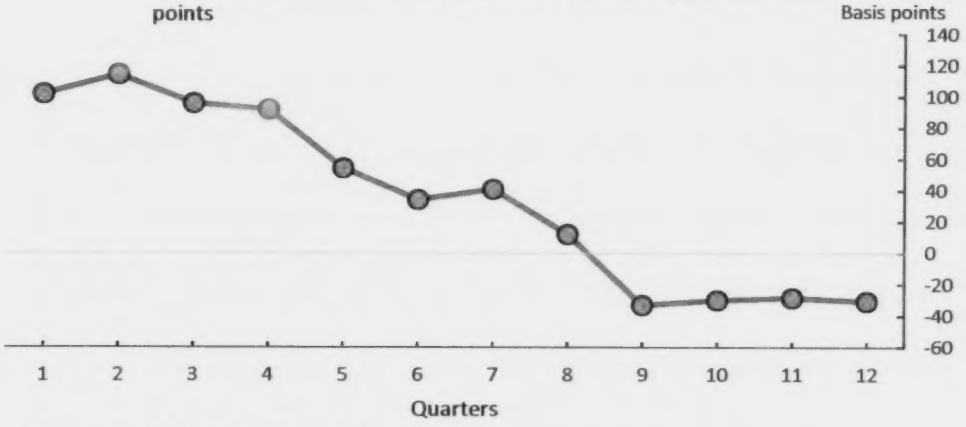


Note: Impulse responses to a 100-basis-point contractionary monetary policy shock with corresponding 68 and 95 per cent confidence bands.
Source: Bank of Canada calculations and estimates

Appendix C: Additional charts and tables

Chart C1: **Response of the Bank Rate to a monetary policy shock**

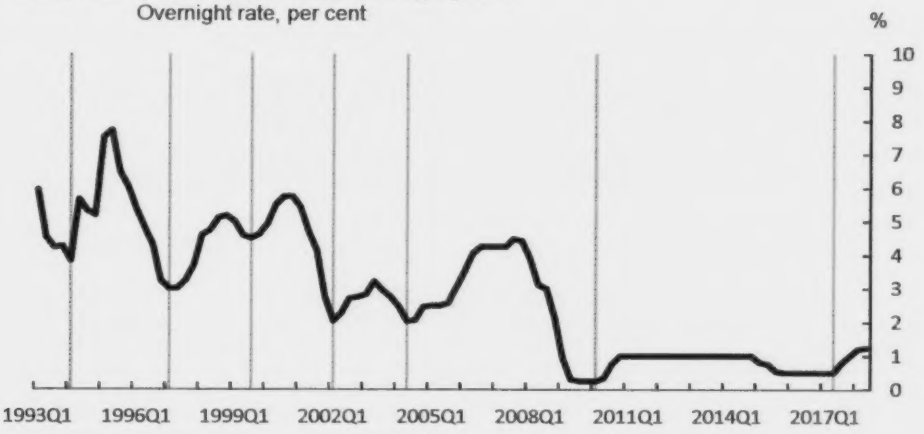
Impact of a 100-basis-point contractionary monetary policy shock, basis points



Source: Bank of Canada calculations and estimates

Chart C2: **Dates of past tightening cycles**

Overnight rate, per cent



Note: Red lines denote the start of past tightening cycles.

Source: Bank of Canada calculations

Last observation: 2018Q2

Table C1: Average deceleration in annual growth rates from start of tightening cycle to 75 per cent of the peak impact of the first interest rate increase by subcomponent, 1993–present

Component	Average growth at time t (excluding 2017Q3), year-over-year per cent (a)	Average growth at 75 per cent of peak, year-over-year per cent (b)	Average growth difference (b-a)
Interest-rate-sensitive components	6.5	3.4	-3.1
New construction	18.0	2.1	-15.9
Ownership transfer cost	3.6	-2.7	-6.2
Renovation	4.8	4.5	-0.3
Vehicle purchases	7.5	-2.4	-9.9
Other transportation services	2.8	1.9	-0.9
Communications	5.6	6.3	0.8
Furniture	5.1	3.0	-2.2
Food, beverage and accommodation services	2.9	1.7	-1.2
Dwelling maintenance	4.5	3.1	-1.4
Moderately and not sensitive components	3.4	2.9	-0.5

Source: Bank of Canada calculations